

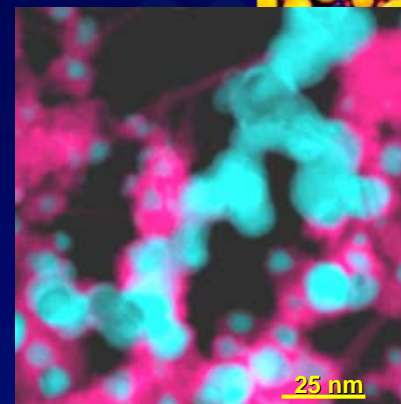
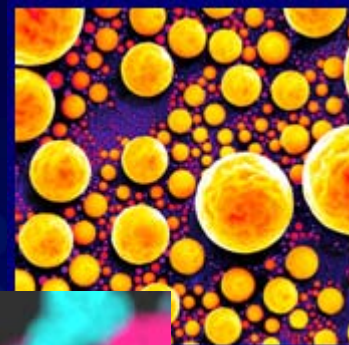
NIST / NNI activities for EHS of Engineered Nanomaterials

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n a n o t e c h n o l o g y

Environmental, Health & Safety (EHS) of Nanomaterials

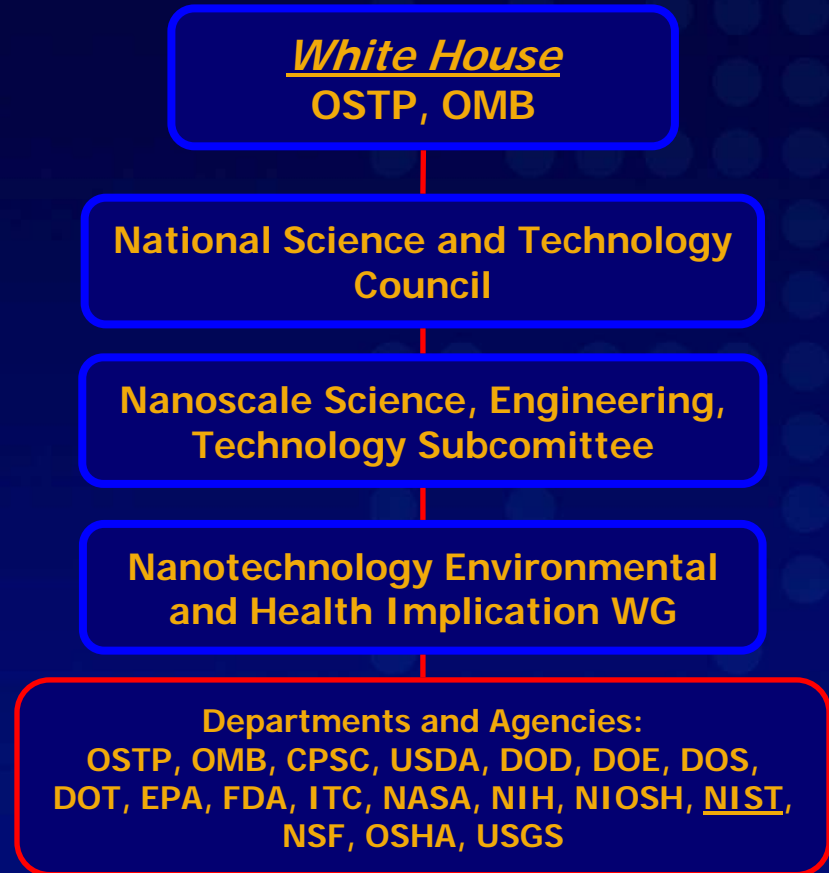
- The National Nanotechnology Initiative (NNI):
 - prioritizes and invests in EHS research
 - strengthening coordination of nano-related EHS research (government, NPOs, academia, industry)
- International collaboration and cooperation in research, standards development and related activities ISO, ASTM, OECD, ICON, etc.

“To ensure that nanoscience research leads to the responsible development of beneficial applications, high priority should be given to research on societal implications, human health, and environmental issues related to nanotechnology.”

Environmental, Health & Safety (EHS) Aspects of Nanomaterials

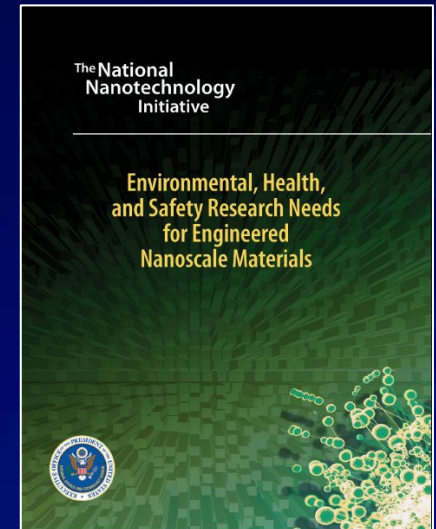
- Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the National Science and Technology Council's Committee on Technology
 - reports to OSTP and OMB
- In 2003, NSET created the Nanotechnology Environmental and Health Implication Working Group (NEHI) to:
 - support Federal activities to protect public health and the environment
 - facilitate identification, prioritization, and implementation of research and other activities
 - responsible research, development, utilization, and oversight of nanotechnology

Structure of NEHI WG within the NNI Organization



NEHI Working Group

- NEHI developed document identifying EHS research and information needs for engineered nanoscale materials released September 2006 by NSET
- Input from industry, academia, and other expert bodies
- Primarily for use by NNI agencies in planning research programs
- Identifies research and information needs
 - risk assessment
 - risk management



available at www.nano.gov

Needs Identified by NNI / NEHI

5 Topical Areas with Research

- Instrumentation, Metrology, and Analytical Methods
- Nanomaterials and Human Health
- Nanomaterials and the Environment
- Health and Environmental Surveillance
- Risk Management Methods

The NNI expects NIST to lead efforts to develop tools necessary for assessing EHS of nanomaterials.

n a n o t e c h n o l o g y

NEHI Activities Since Publication of the Research Needs Document

- **Public Meeting, January 4, 2007**
 - received input from the public on research needs related to the environmental, health, and safety aspects of engineered nanoscale materials
 - comments received on the research needs and prioritization criteria
 - provided an opportunity for public participation in the prioritization
 - Presentation and comments available at www.nano.gov/public_ehs.html
- **General consensus was the needs outlined in the document were comprehensive and well thought out.**

Prioritization Efforts

- working groups set up for each topical area to prioritize research needs based on the value of information
 - NIST is the lead on the Instrumentation, Metrology, and Analytical Methods
- number of parameters considered:
 - extent of use expected for nanomaterial
 - exposure potential for workers, consumers, or the environment to the nanomaterial being used in or developed for applications
 - potential to leverage relevant existing data
 - potential to integrate toxicological or risk assessment as part of design or engineering approaches
 - potential to leverage international/private sector research efforts
- public meeting comments

Prioritization Efforts Cont.

- OMB Data Call Fall 2007.
- Working groups have reviewed the results from the data and are in the process of identifying the gaps in research for each of the topical areas.
- Coordinate and facilitate among the NNI agencies to address priorities – Research Strategy
- Establish a process for periodic review
- Target date for draft research needs prioritization document early 2008.

Workshop on Standards for EHS Research Needs for Engineered Nanoscale Materials 9/12 – 9/13 2007

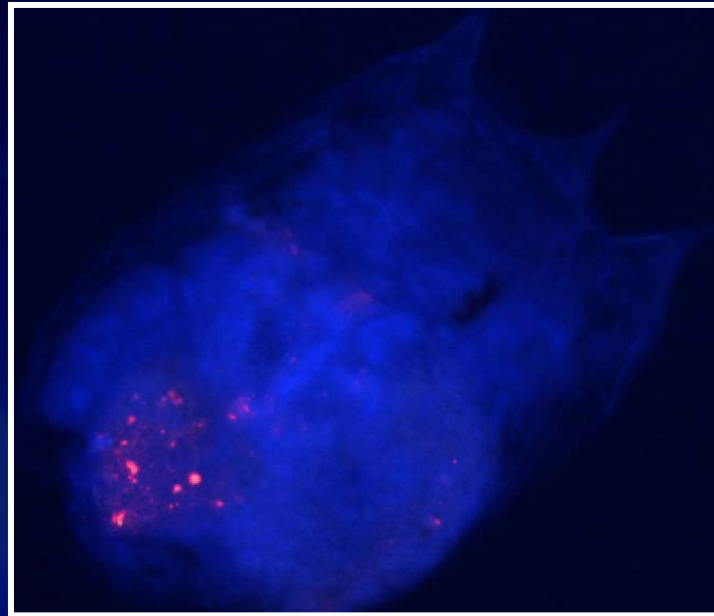


Image courtesy of David Holbrook, NIST

**Sponsored by National Nanotechnology Initiative, Hosted and
primarily funded by NIST**

Workshop Overview

To focus on the identification of standard materials needed to address toxicology, risk assessment and risk management of engineered nanoscale materials and the technical challenges for the development of such materials to further enable nanomaterial risk management decision making processes and progress for the regulatory community and industry.

Goals of the Workshop

- 1) Develop Approaches for Identifying Standard Materials for Critical Risk Assessment and Risk Management**
- 2) Nomination of Materials Specific to User and Community Needs**
- 3) Identify Critical Materials Characterization Parameters Required to Meet Needs of Specific Users and Communities**
- 4) Identify Priority Reference Materials, Characterizations and time-scales for Development**

Workshop Organization

Four Breakout groups

- Group A: Cross Cut Issues in Development of Standard Materials: Areas that impact multiple users and communities
 - ❖ challenges in material considerations, experimental methods, production (sources, volumes); time scales or cost
 - ❖ policy, international standards cooperation
 - ❖ interagency collaboration, coordination; inter-laboratory comparisons
- Group B: Materials for Occupational Exposure
 - ❖ Reference materials for risk assessment, risk management, and characterization of nanoparticle exposure in the workplace
 - ❖ materials for inhalation, ingestion, skin absorption, other routes
 - ❖ materials to support international consensus standards for nanoparticle exposure

Workshop Organization

— Group C: Materials for Environmental Fate and Transport

- ❖ assess environmental exposure to nanomaterials in air, water and soil
- ❖ determine fate and transport once released into the environment
- ❖ understand their subsequent behavior and fate
 - ❖ mixing, dispersing, concentrating, agglomerating, decomposing, reacting, transformations

— Group D: Materials for Human & Ecological Health

- ❖ assessment of the biological response to engineered nanoscale materials via environmental or non-incident exposure to humans and other living systems (aquatic, plants, animals)
- ❖ understand effects on subcellular components, cells, tissues, organs, organ systems, and whole organisms (e.g., bioaccumulation, toxicity)

Human and Ecological Health Breakout Group:

Review of Day 1 Outcomes from the Material Nomination Process

	Key criteria for nominating Materials/Group of Materials			
	1: Applied toxicology	2: Fundamental Research	3: Metrology	4: Reference toxicant
“Tier 1” materials	<ul style="list-style-type: none"> •Silver •Zero valent Fe •CeO₂ •TiO₂ •SWCNT/MWCNT 	<ul style="list-style-type: none"> •Dendrimers •“C₆₀” •Gold •Quantum dots •Polystyrene (fluorescent) •SiO₂ 	<ul style="list-style-type: none"> •Gold •Quantum dots •Dendrimers •Polystyrene (fluorescent) 	<ul style="list-style-type: none"> •TiO₂ •“C₆₀” •Carbon black
“Tier 2” materials	<ul style="list-style-type: none"> •ZnO •SiO₂ •Metal & Metal oxides •Gold •“C₆₀” 	<ul style="list-style-type: none"> •Metal & Metal oxides •Silver •CeO₂ •TiO₂ •SWCNT/MWCNT 	<ul style="list-style-type: none"> •SiO₂ •Polystyrene (fluorescent) •“C₆₀” •SWCNT/MWCNT 	<ul style="list-style-type: none"> •SiO₂ •Dendrimers

1: Applied toxicology

- High production volume; could be a benchmark
- High potential risk of exposure; human & ecological risk relevance
- Public perceptions

2: Fundamental Research

- Can be made in range of sizes, shapes, or surface modifications
- Potential to answer quantitative structure activity questions

3: Metrology

- Constant, stable material with high purity and uniformity

4: Reference toxicant

- Benchmark positive or negative material
- Large amount of existing or potential datasets
- Translates in vivo to in vitro results
- Well studied

NIST / NNI activities for EHS of Engineered Nanomaterials

- Where are we today?

- Workshop report scheduled for release early 2008.
- NNI EHS-related research activities and coordination is expanding.
- International collaboration and cooperation in research, standards development is increasing.
- NIST is working within the NNI to meet EHS research needs for instrumentation, metrology, and analytical methods.